

F I G. 1

FOIL COATING

F I G. 3

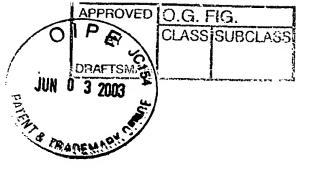
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	Χ ₁	X ₂	X ₃	X	X ₅	X	X ₇	X	X_9	X ₁₀	X ₁₁	X ₁₂	X ₁₃	X ₁₄	X ₁₅
,	18,7	28,2	37,2	47	56,4	65,6	75	84,3	93,3	102,9 112,3	112,3	122	131,4 140,8	140,8	150

test sample

native starch **a** in wt. % **b** = 250 wt. % water (in relation to dry mass of fiber material)

c = 100 wt. % fiber material



		٠	
Hallve Starch			

		1	
	y15		75
	y14		150
T	y13		300
	y12		281 300
	y11	·	283
	y8 y9 y10 y11 y12 y13 y14 y15		225 244 283
	99		225
	у8		20Ġ
	у7		188 206
	уб		169
	у5		150
	y 4		113 131
	у3		113
	у2		84
	y1		25
•	test sample		а

a = native starch in percent by weight

b = 500 wt. % water in relation to fiber material (dry substance)

c = 100% fiber material

F I G. 4b

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	X	X ₂	X ₃	X	X ₅	×°	X ₇	× ₈	X	$X_{10} X_{11}$		X ₁₂	X	X ₁₄	X ₁₅
Ø	18,7	28,2	37,3	47	56,4	65,8	75	84,3	93,3	102,9 112,3	112,3	122	131,4 140,8	140,8	150
р	6,3	9,1	12,7	15,7	18,8	21,9	25	28,3	31,3	34,9	37,7	40,7	43,8	46,9	20
a	24,9	37,8	20	62,7	75,2	7,78	100	00 112,7	124,7 137,8	137,8	150	162,7 175,2 187,7	175,2	187,7	200

test sample X₁₋₁₅ **a** in wt. %

native starch

pregelatinized starch **d** in wt. %

total starch **e** in wt. % water (in relation to dry mass of fiber material) b = 250 wt. %

c = 100 wt. % fiber material

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ratios

test sample														·	
	y1	y2	y1 y2 y3 y4		35	y6 y7		98	99	y10	y11	y10 y11 y12 y13 y14	y13	y14	y15
,	25	94	113 131		150	169	188	205	225	24.4	283	261	300	300 150	75.
þ	75	31	38	44	20	58	63	69	75	81	86	94	100	100 100	100
	-09	75	100	100 125	150	175	200 225		250	275	300	325		350 375	400

a = native starch in wt. %

d = pregelatinized starch in wt. %

e = total starch in wt. %

b = 500 wt. % water in relation to fiber material (dry substance)

c = 100% fiber material

F I G. 5b

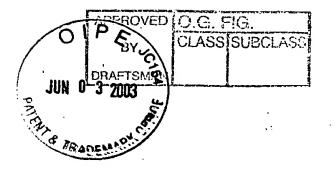
APPROVED O.G. FIG.

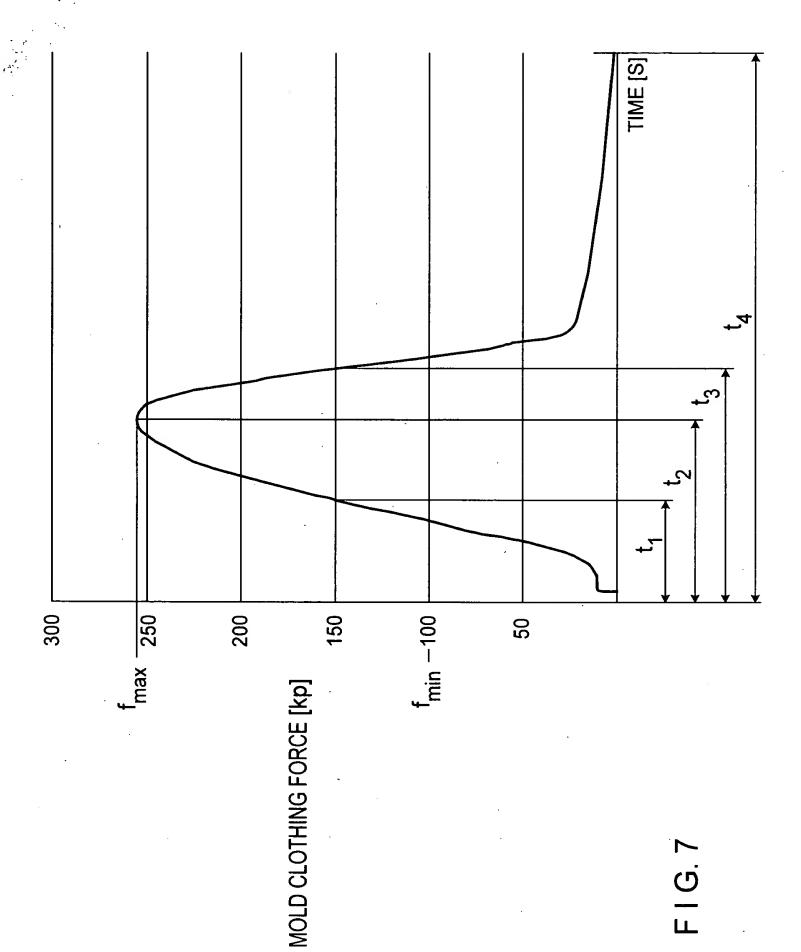
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	<u> </u>
Grade	Long fibers/ fiber bundles [mm]
1	0.96 - 1.44
2	1.92 - 2.40
3	2.40 - 2.88
4	0.72 - 2.16
5	3.06 - 3.57
6	2.55 - 4.59
7	0.24 - 1.68
8	0.24 - 4.32

<u> </u>	1	. 1.	2	ı	3	4	5
	L	1					L in mm
•			2				
		•		3	ı		
		4			,- -		
		_			5		
	7			L		6	
				3			_

F I G. 6





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RAPEMAN APPLIANCE OF THE PROPERTY OF T

Use of fibers (fiber bundles) graded by fiber length according to Fig. 6

		<u> </u>							
	ω	,	+	+		∞	+	+	+
	7	+	+	+		7	+	+	+
	9	+	+	+		9	+	+	+
٦	2	+	·1	•	ιL	5	.+	,	ı
= 50 mm	4	+	+	+	> 80 mm	4	+	+	+
11	က	+	,	1	^	က	+	١.	ı
	5 .	+	ı	ı		2	+	,	ı
	←	+	l l	1			+		ı
					,				
-	∞	1	+	+		ω	+	+	+
	7	+	+	+		7	+	+	+
	9	'	ı	+		9	+	+	+
٦	5	+	ı	1	E	5	+		ı
=30 mm	4	+	+	+	= 80 mm	4	+	+	+
H 33	က	+	ı	ı	II	က	+	,	ı
	2	+	I	1		2	+	,	ı
		+		•		←	+	•	ı
mold depth	fiber length	surface/ texture	strength/ stability	elasticity/ structure	mold depth	fiber length	surface/ texture	strength/ stability	elasticity/ structure

+ molded body according to requirements

П С

⁻ molded body not according to requirements

Use of fibers mixtures of different fiber length according to Fig. 6

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			11/	22		
	9 + 8	+	+	+		
> 80 mm	7 + 2 + 6	•	+	+	45 : 55	0,3 : 1
	∞	+	+	+		
= 80 mm	7 + 2 + 3 + 5	1	+	+	50 : 50	0,4 : 1
	8	+	+	+		
nm	4 + 2 + 3	+	+	1	55 : 45	··
= 50 mm	7 + 2 + 3	ı	+	+	22	0,4
= 30 mm	4 + 2	+	+	+	60 : 40	1
= 30	7 + 4	ı	+	ı	09	0,4 : 1
mold depth	combination of fiber length according to Fig. 6	surface/ texture	strength/ stability	elasticity/ structure	fiber material/ starch	starch/water

+ molded body according to requirements

F | G 9

⁻ molded body not according to requirements

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in wt. %	$X_1 \mid X_2 \mid X_3 \mid X_4 \mid X_5$	X_2	× ₃	×	X	×	×	×	×	$X_6 \mid X_7 \mid X_8 \mid X_9 \mid X_{10} \mid X_{11} \mid X_{12} \mid X_{13} \mid X_{14} \mid X_{15}$	X ₁₁	X ₁₂	X ₁₃	X ₁₄	X ₁₅
fiber material to total mass	26,7	26,7 25,8	25	24,2 23,5	23,5	22,8	22,8 22,2 21,6	21,6	21,1 20,5	20,5	20	19,5	19	10,6	18,2
total starch to total mass	9'9	2,6	6,6 9,7 12,5 15,2 17.7	15,2	17.7	20,1	20,1 22,2 24,3	24,3	26,2 28,2	28,2	10	10 11,7 33,4 34,9	33,4	34,9	16,3
water to total mass	66,7	64,5	66,7 64,5 62,5 60,6 58,8	9,09	58,8	57,1	57,1 55,6 54,1 52,7 51,1	54,1	52,7	51,1	50	48,8	47,6	48,8 47,6 46,5	15,5
pragelatinized starch to total mass	1,6	2,4	1,6 2,4 3,2 3,8 4,4	3,8	4,4	2	5,5	6,1	9,9	6,6 7,1 7,5 7,9 8,4 8,7	7,5	6'2	8,4	8,7	თ

X₁₋₁₅ test sample

F | G 10

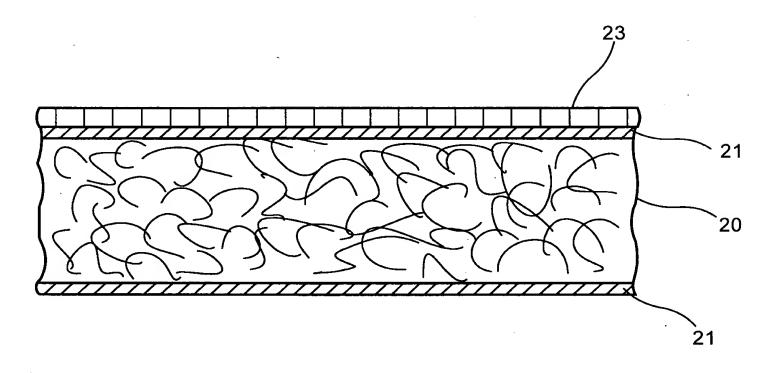


Percent by weight in mass

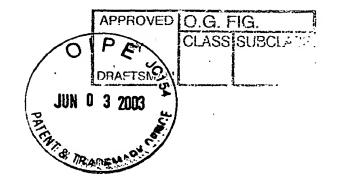
in wt. %	y1	y1 y2 y3 y4 y5	у3	y4	y5	ye	y7	, y	6	y10	y11	y12	y13	y6 y7 y8 y9 y10 y11 y12 y13 y14 y15	y15
fiber/mass	14,3	14,3 13,8 13,3 12,9 12,5	13,3	12,9	12,5	12,1	11,8	11,4	11,1	10,8	10,5	10,3	10,0	12,1 11,8 11,4 11,1 10,8 10,5 10,3 10,0 11,8 12,9	12,9
total starch/ mass	14,3	14,3 17,2 20,0 22,6 25,0	20,0	22,6	25,0	27,3	29,4	31,4	33,3	35,1	36,8	38,5	40,0	27,3 29,4 31,4 33,3 35,1 36,8 38,5 40,0 29,4 22,6	22,6
pregelatinized starch/mass	10,7	10,7 4,3 5,0 5,6	5,0	5,6	6,3	9'9	7,4	7,9	8,3	8,8	9,2	9,6	10,0	6,6 7,4 7,9 8,3 8,8 9,2 9,6 10,0 11,8 12,9	12,9
water/mass	71,4	71,4 69,0 68,7 64,5 62,5	68,7	64,5	62,5	8'09	58,3	57,1	55,6	54,1	52,8	51,3	50,0	60,8 58,3 57,1 55,6 54,1 52,8 51,3 50,0 58,8	64,5

y1-15 = test sample

F G. 11



F I G. 12



Trays dimensions 112 x 200 x 17.5 mm

Pots dimensions ϕ 125 mm, vol. 500 ml, height 76 mm

Recipe: Y14

Coating: cellulose acetate (CA)

TS: 4.5% - 15 wt. % dry substance in spray solution

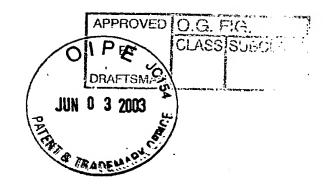
η: 20 - 4000 mPas (viscosity)

Application: spraying, casting, dipping

Layers: 1 - 3 (quantity)

Solvent: acetone

Shape	Thick- ness	Coating	Method	water 100ºC 1h	Resistance oil (cold) 3 days	water (cold) 3 days
pot	89 μm	3.8 g	casting	+	+	+
tray	79 μm	2.3 g	casting	+	+	+
pot	65 μm	2.8 g	spraying	+	+	+
tray	68 μm	2.0 g	spraying	+	+	+
tray	58 μm	1.7 g	spraying	+	+	· +
pot	34 μm	1.5 g	spraying	<u>-</u>	-	-
tray	27 μm	0.8 g	spraying	-	<u>-</u>	-



Trays dimensions 112 x 200 x 17.5 mm

Pots dimensions \$\phi\$ 125 mm, vol. 500 ml, height 76 mm

Recipe: Y14

Coating: cellulose acetate propionate (CAP)

TS: 9% - 20 wt. % dry substance in spray solution

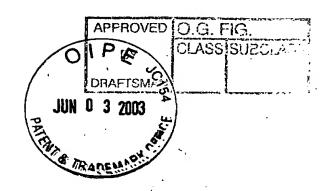
η: 200 - 6000 mPas (viscosity)

Application: spraying, casting, dipping

Layers: 1 - 3 (quantity)

Solvent: acetone

Shape	Thickness	Method		Resistance	
			water 100ºC	oil cold	water cold
			1h	3 days	· 3 days
pot	88 μm	casting	+	+	+
tray	88 μm	casting	+	+	+
pot	58 μm	spraying	+	+	+
tray	70 μm	spraying	+	+	+
tray	56 μm	spraying	+	+	+
pot	33 _. μm	spraying	-	-	-
tray	22 μm	spraying	-	-	_

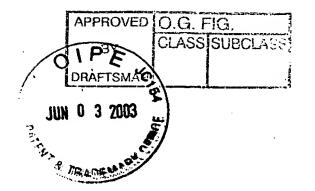


Trays dimensions 112 x 200 x 17.5 mm

Pots dimensions ϕ 125 mm, vol. 500 ml, height 76 mm

No.	Foil	Thick- ness	Deep- drawing	Deep- drawing		Resistanc	
		11033	quality in tray	quality in tray	water 100ºC	oil cold	water cold
1	polyester	100 μm	+	-	-	+	+
	amide	150 μm	+	-		+	+
2	polyester	70 μm	+	-	_	+	+
3	polylactic acid	50 μm	-		, -	+	+
	(rigid)	100 μm	· _	-	-	+	+
4	polylactic acid (elast.)	50 μm 100 μm	+ +	+	+	+	+

Foil	Melting point
1	approx. 120°C
2	approx. 85°C
3	approx. 115°C
4	approx. 130°C



Cellulose acetate / Cellulose acetate propionate

		Softener	Softener 10 - 30 wt. %		
	Diethyl - phthalate	Triacetin	Tributyl	Acetyl tributyl citrate	Without softener
CA	CA V+/H+	+ H / + A	- H/- A	- H / - A	ОН
CAP	CAP V + / H +	+ H / + A	+ H / + A	+ H / + A	+ H

Key: + = good o = medium

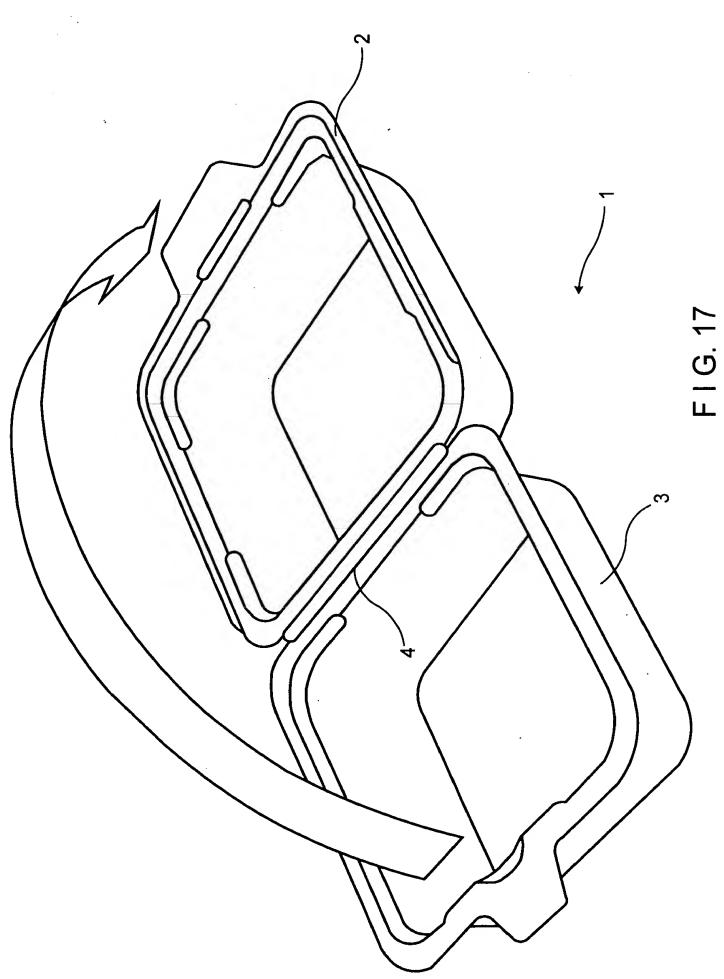
- = poor

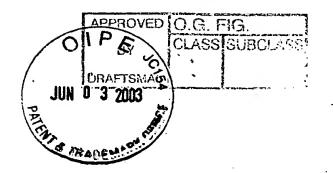
V = compatibility

H = adhesion

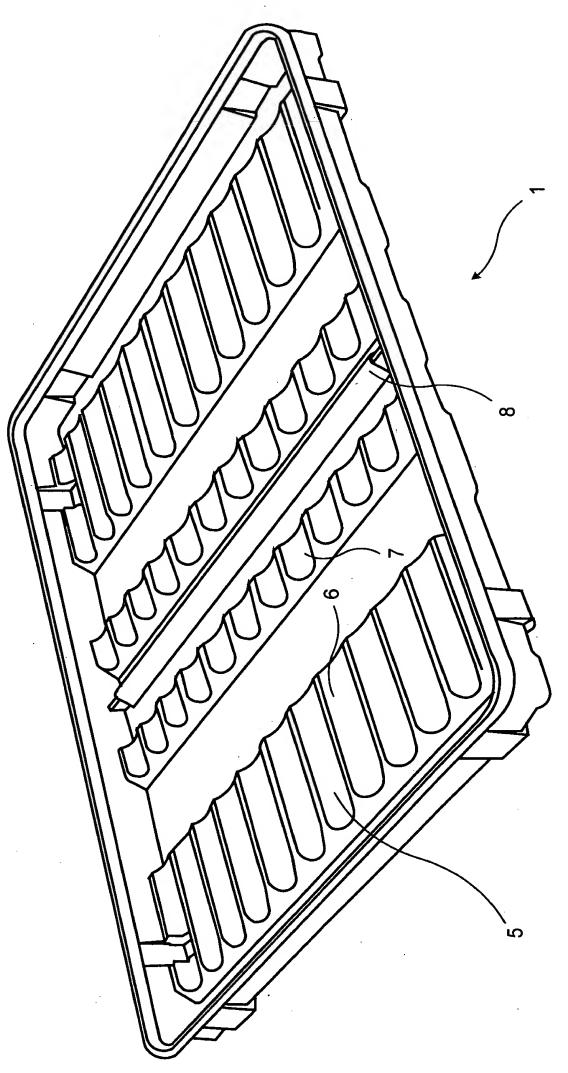
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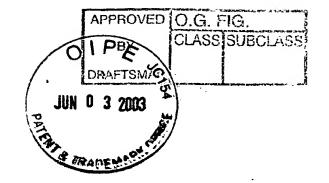


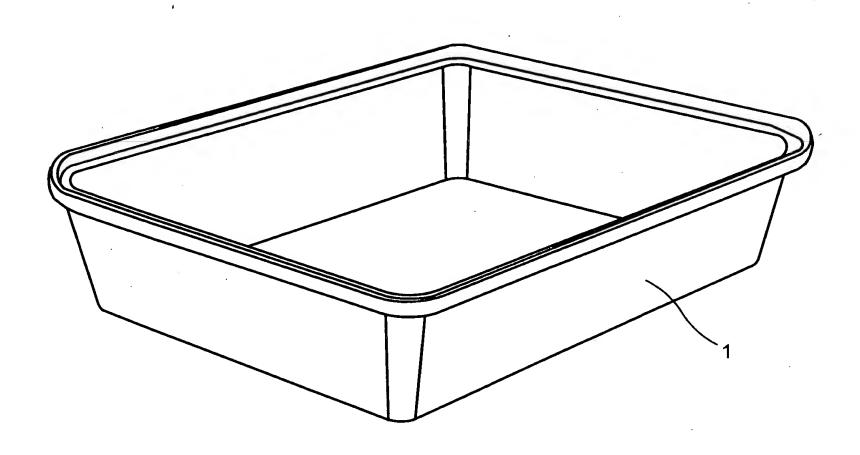


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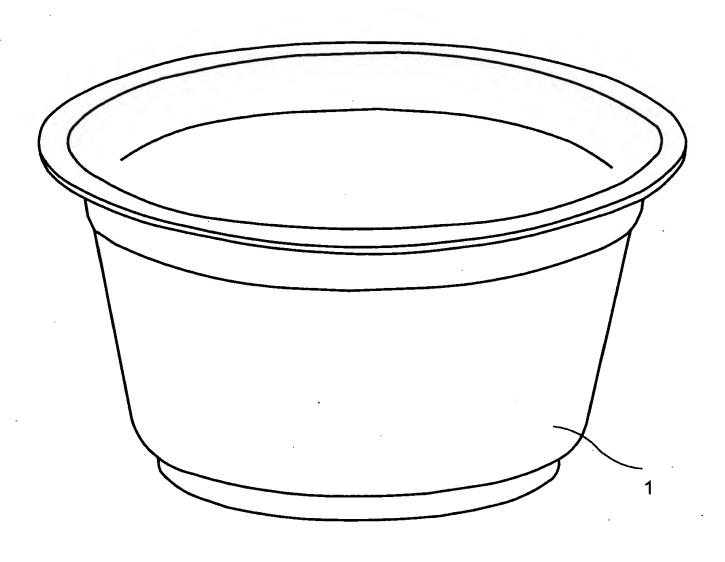


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F I G. 19



F I G. 20